UNITED STATES NAVAL OBSERVATORY

CIRCULAR NO. 7

U. S. Naval Observatory, Washington 25, D. C. February 1, 1950

EPHEMERIDES OF PALLAS AND CERES, 1950

With the cooperation of the British Nautical Almanac Office, and with the primary object of encouraging accurate observations of Ceres, Pallas, Juno, and Vesta, it is intended to publish precise ephemerides of these planets for the period during which they transit the meridian when the Sun is below the horizon, between latitudes 56° north and 34° south. Theoretical studies (see *Astronomical Journal*, **54**, 10, 1948) have indicated that if these four planets are assiduously observed with transit circles the positions of the equinox and equator among the stars can be found with greater accuracy than by observations of any other objects. Photographic observations should be equally valuable for the equinox determination, although they are not suitable for direct determinations of fundamental declinations.

The ephemerides, supposed to be accurate to a few seconds of arc, serve a dual purpose. They serve for easy identification of the planet in the restricted field of view of a transit circle; and, equally for visual and photographic observations, the discordances between the ephemerides and the observations may be analyzed for the determination of differential corrections to the assumed star positions, and to various astronomical constants.

The rectangular equatorial heliocentric coordinates have been obtained by numerical step-by-step integration of their second derivatives with respect to

the time, at 20-day intervals. This work is a portion of a joint undertaking, sponsored by the Office of Naval Research, of the U. S. Naval Observatory, the Yale University Observatory, and the Watson Scientific Computing Laboratory. The actual integrations have been made at the Cincinnati Observatory, while the necessary differential corrections of the orbits have been made in the Office of the American Ephemeris. The results will be published in full in the *Astronomical Papers of the American Ephemeris.*

The geocentric ephemerides will appear eventually in the *American Ephemeris* and in the British *Nautical Almanac.* Pending the time when the ephemerides can be incorporated in these volumes they will appear in this series of circulars. The ephemeris of Juno for the opposition of 1950 appeared in *Circular* No. 5. The data in the present circular were calculated in the British Nautical Almanac Office.

The apparent ephemeris is immediately comparable with a meridian observation corrected for geocentric parallax. But it is to be specially noted that this ephemeris, in common with the ephemerides of the Sun, Moon, and other planets, is free from the effects of the short-period terms of the nutation, and hence is inconsistent with observed positions derived from clock corrections that are affected by short-period terms, or from nadirs. Meridian observers are cautioned that inattention to this point may result in important errors.

The astrometric ephemeris, obtained by applying the reduction in the column *Red. to Astrom. Place* to the apparent ephemeris, is referred to the mean equinox and equator 1950.0, and is affected by the elliptic term of the annual aberration. It is therefore immediately comparable with photographic positions obtained by comparing the planet with catalogue mean places of neighboring stars, it being only necessary to correct the observations for geocentric parallax.

FOR 0^h UNIVERSAL TIME

Date	Apparent Right Ascension		Red. to Astrom. Place	Apparent Declination		Red. to Astrom. Place	True Distance from Earth		Hor. Parallax	Transit, Meridian of Greenwich
	h m s	s	s	° ′ ″	″	′ ″			″	h m
Jan. 1	14 31 05.16	+ 91.36	+ 0.85	− 1 24 52.5	+ 239.3	+0 05.2	2.721 010	− 9716	3.23	7 50.0
2	14 32 36.52	90.81	0.83	1 20 53.2	249.4	0 05.4	2.711 294	9765	3.25	7 47.6
3	14 34 07.33	90.25	0.80	1 16 43.8	259.8	0 05.7	2.701 529	9812	3.26	7 45.2
4	14 35 37.58	89.69	0.78	1 12 24.0	270.3	0 06.0	2.691 717	9857	3.27	7 42.7
5	14 37 07.27	89.10	0.75	1 07 53.7	280.7	0 06.3	2.681 860	9900	3.28	7 40.3
6	14 38 36.37	+ 88.51	+ 0.73	− 1 03 13.0	+ 291.2	+0 06.5	2.671 960	− 9942	3.29	7 37.8
7	14 40 04.88	87.91	0.70	0 58 21.8	302.0	0 06.8	2.662 018	9983	3.31	7 35.3
8	14 41 32.79	87.30	0.68	0 53 19.8	312.8	0 07.1	2.652 035	10021	3.32	7 32.9
9	14 43 00.09	86.67	0.65	0 48 07.0	323.7	0 07.4	2.642 014	10058	3.33	7 30.4
10	14 44 26.76	86.03	0.62	0 42 43.3	334.6	0 07.6	2.631 956	10094	3.34	7 27.9
11	14 45 52.79	+ 85.38	+ 0.60	− 0 37 08.7	+ 345.8	+0 07.9	2.621 862	−10127	3.36	7 25.4
12	14 47 18.17	84.71	0.57	0 31 22.9	356.9	0 08.2	2.611 735	10158	3.37	7 22.9
13	14 48 42.88	84.02	0.55	0 25 26.0	368.2	0 08.5	2.601 577	10187	3.38	7 20.3
14	14 50 06.90	83.32	0.52	0 19 17.8	379.6	0 08.7	2.591 390	10215	3.40	7 17.8
15	14 51 30.22	82.62	0.50	0 12 58.2	391.0	0 09.0	2.581 175	10238	3.41	7 15.2
16	14 52 52.84	+ 81.88	+ 0.47	− 0 06 27.2	+ 402.5	+0 09.3	2.570 937	−10261	3.42	7 12.7
17	14 54 14.72	81.14	0.44	+ 0 00 15.3	414.2	0 09.5	2.560 676	10280	3.44	7 10.1
18	14 55 35.86	80.38	0.42	0 07 09.5	425.8	0 09.8	2.550 396	10298	3.45	7 07.5
19	14 56 56.24	79.61	0.39	0 14 15.3	437.5	0 10.1	2.540 098	10311	3.46	7 04.9
20	14 58 15.85	78.82	0.36	0 21 32.8	449.3	0 10.4	2.529 787	10323	3.48	7 02.3
21	14 59 34.67	+ 78.02	+ 0.34	+ 0 29 02.1	+ 461.1	+0 10.6	2.519 464	−10331	3.49	6 59.7
22	15 00 52.69	77.21	0.31	0 36 43.2	473.0	0 10.9	2.509 133	10337	3.51	6 57.0
23	15 02 09.90	76.37	0.28	0 44 36.2	484.9	0 11.1	2.498 796	10341	3.52	6 54.4
24	15 03 26.27	75.54	0.26	0 52 41.1	496.8	0 11.4	2.488 455	10342	3.54	6 51.7
25	15 04 41.81	74.67	0.23	1 00 57.9	508.8	0 11.7	2.478 113	10340	3.55	6 49.0
26	15 05 56.48	+ 73.81	+ 0.20	+ 1 09 26.7	+ 520.8	+0 11.9	2.467 773	−10335	3.57	6 46.3
27	15 07 10.29	72.92	0.18	1 18 07.5	532.9	0 12.2	2.457 438	10328	3.58	6 43.6
28	15 08 23.21	72.03	0.15	1 27 00.4	544.9	0 12.4	2.447 110	10318	3.60	6 40.9
29	15 09 35.24	71.11	0.12	1 36 05.3	557.0	0 12.7	2.436 792	10306	3.61	6 38.1
30	15 10 46.35	70.19	0.10	1 45 22.3	569.1	0 12.9	2.426 486	10291	3.63	6 35.4
31	15 11 56.54	+ 69.24	+ 0.07	+ 1 54 51.4	+ 581.3	+0 13.2	2.416 195	−10274	3.64	6 32.6
Feb. 1	15 13 05.78	68.29	0.04	2 04 32.7	593.4	0 13.4	2.405 921	10254	3.66	6 29.8
2	15 14 14.07	67.32	+ 0.01	2 14 26.1	605.5	0 13.7	2.395 667	10232	3.67	6 27.0
3	15 15 21.39	66.33	− 0.01	2 24 31.6	617.8	0 13.9	2.385 435	10207	3.69	6 24.2
4	15 16 27.72	65.33	0.04	2 34 49.4	629.9	0 14.2	2.375 228	10180	3.70	6 21.4
5	15 17 33.05	+ 64.32	− 0.07	+ 2 45 19.3	+ 642.2	+0 14.4	2.365 048	−10150	3.72	6 18.5
6	15 18 37.37	63.28	0.10	2 56 01.5	654.3	0 14.6	2.354 898	10117	3.74	6 15.6
7	15 19 40.65	62.22	0.12	3 06 55.8	666.6	0 14.9	2.344 781	10083	3.75	6 12.7
8	15 20 42.87	61.15	0.15	3 18 02.4	678.9	0 15.1	2.334 698	10045	3.77	6 09.8
9	15 21 44.02	60.06	0.18	3 29 21.3	691.0	0 15.3	2.324 653	10004	3.79	6 06.9
10	15 22 44.08	+ 58.95	− 0.21	+ 3 40 52.3	+ 703.3	+0 15.6	2.314 649	− 9961	3.80	6 04.0
11	15 23 43.03	57.82	0.23	3 52 35.6	715.4	0 15.8	2.304 688	9913	3.82	6 01.0
12	15 24 40.85	56.67	0.26	4 04 31.0	727.5	0 16.0	2.294 775	9863	3.83	5 58.1
13	15 25 37.52	55.50	0.29	4 16 38.5	739.6	0 16.2	2.284 912	9810	3.85	5 55.1
14	15 26 33.02	54.32	0.31	4 28 58.1	751.6	0 16.4	2.275 102	9753	3.87	5 52.0
15	15 27 27.34	+ 53.11	− 0.34	+ 4 41 29.7	+ 763.5	+0 16.7	2.265 349	− 9692	3.88	5 49.0
16	15 28 20.45		− 0.37	+ 4 54 13.2		+0 16.9	2.255 657		3.90	5 45.9

Approximate magnitude = 8.5

FOR 0^h UNIVERSAL TIME

Date	Apparent Right Ascension		Red. to Astrom. Place	Apparent Declination		Red. to Astrom. Place	True Distance from Earth		Hor. Parallax	Transit, Meridian of Greenwich
	h m s	s	s	° ′ ″	″	′ ″			″	h m
Feb. 16	15 28 20.45	+ 51.89	− 0.37	+ 4 54 13.2	+ 775.3	+0 16.9	2.255 657	− 9629	3.90	5 45.9
17	15 29 12.34	50.64	0.40	5 07 08.5	787.0	0 17.1	2.246 028	9562	3.92	5 42.9
18	15 30 02.98	49.39	0.43	5 20 15.5	798.6	0 17.3	2.236 466	9490	3.93	5 39.8
19	15 30 52.37	48.12	0.45	5 33 34.1	810.1	0 17.5	2.226 976	9415	3.95	5 36.7
20	15 31 40.49	46.83	0.48	5 47 04.2	821.4	0 17.7	2.217 561	9338	3.97	5 33.5
21	15 32 27.32	+ 45.53	− 0.51	+ 6 00 45.6	+ 832.6	+0 17.9	2.208 223	− 9257	3.99	5 30.4
22	15 33 12.85	44.20	0.53	6 14 38.2	843.6	0 18.1	2.198 966	9172	4.00	5 27.2
23	15 33 57.05	42.87	0.56	6 28 41.8	854.5	0 18.3	2.189 794	9084	4.02	5 24.0
24	15 34 39.92	41.51	0.59	6 42 56.3	865.1	0 18.4	2.180 710	8993	4.04	5 20.7
25	15 35 21.43	40.15	0.62	6 57 21.4	875.6	0 18.6	2.171 717	8899	4.05	5 17.5
26	15 36 01.58	+ 38.77	− 0.65	+ 7 11 57.0	+ 886.0	+0 18.8	2.162 818	− 8800	4.07	5 14.2
27	15 36 40.35	37.38	0.67	7 26 43.0	896.0	0 19.0	2.154 018	8699	4.09	5 10.9
28	15 37 17.73	35.98	0.70	7 41 39.0	905.9	0 19.1	2.145 319	8595	4.10	5 07.6
Mar. 1	15 37 53.71	34.55	0.73	7 56 44.9	915.5	0 19.3	2.136 724	8488	4.12	5 04.3
2	15 38 28.26	33.11	0.76	8 12 00.4	925.0	0 19.5	2.128 236	8377	4.13	5 00.9
3	15 39 01.37	+ 31.67	− 0.78	+ 8 27 25.4	+ 934.2	+0 19.6	2.119 859	− 8264	4.15	4 57.5
4	15 39 33.04	30.20	0.81	8 42 59.6	943.2	0 19.8	2.111 595	8147	4.17	4 54.1
5	15 40 03.24	28.72	0.84	8 58 42.8	951.9	0 19.9	2.103 448	8028	4.18	4 50.7
6	15 40 31.96	27.23	0.87	9 14 34.7	960.3	0 20.0	2.095 420	7905	4.20	4 47.2
7	15 40 59.19	25.73	0.90	9 30 35.0	968.5	0 20.2	2.087 515	7779	4.22	4 43.7
8	15 41 24.92	+ 24.20	− 0.92	+ 9 46 43.5	+ 976.3	+0 20.3	2.079 736	− 7651	4.23	4 40.2
9	15 41 49.12	22.66	0.95	10 02 59.8	983.8	0 20.4	2.072 085	7518	4.25	4 36.7
10	15 42 11.78	21.10	0.98	10 19 23.6	991.1	0 20.5	2.064 567	7383	4.26	4 33.1
11	15 42 32.88	19.54	1.01	10 35 54.7	998.0	0 20.6	2.057 184	7243	4.28	4 29.5
12	15 42 52.42	17.96	1.03	10 52 32.7	1004.4	0 20.8	2.049 941	7100	4.29	4 25.9
13	15 43 10.38	+ 16.37	− 1.06	+11 09 17.1	+1010.5	+0 20.9	2.042 841	− 6954	4.31	4 22.3
14	15 43 26.75	14.76	1.09	11 26 07.6	1016.1	0 21.0	2.035 887	6804	4.32	4 18.6
15	15 43 41.51	13.15	1.12	11 43 03.7	1021.3	0 21.0	2.029 083	6651	4.34	4 14.9
16	15 43 54.66	11.53	1.15	12 00 05.0	1026.1	0 21.1	2.022 432	6493	4.35	4 11.2
17	15 44 06.19	9.90	1.17	12 17 11.1	1030.3	0 21.2	2.015 939	6334	4.37	4 07.5
18	15 44 16.09	+ 8.27	− 1.20	+12 34 21.4	+1034.1	+0 21.3	2.009 605	− 6169	4.38	4 03.7
19	15 44 24.36	6.64	1.23	12 51 35.5	1037.4	0 21.3	2.003 436	6002	4.39	3 59.9
20	15 44 31.00	4.99	1.26	13 08 52.9	1040.2	0 21.4	1.997 434	5832	4.41	3 56.1
21	15 44 35.99	3.35	1.28	13 26 13.1	1042.3	0 21.5	1.991 602	5659	4.42	3 52.2
22	15 44 39.34	1.71	1.31	13 43 35.4	1044.0	0 21.5	1.985 943	5482	4.43	3 48.3
23	15 44 41.05	+ 0.07	− 1.34	+14 00 59.4	+1045.1	+0 21.5	1.980 461	− 5303	4.44	3 44.4
24	15 44 41.12	− 1.57	1.37	14 18 24.5	1045.7	0 21.6	1.975 158	5121	4.46	3 40.5
25	15 44 39.55	3.20	1.40	14 35 50.2	1045.6	0 21.6	1.970 037	4935	4.47	3 36.5
26	15 44 36.35	4.83	1.42	14 53 15.8	1045.1	0 21.6	1.965 102	4749	4.48	3 32.5
27	15 44 31.52	6.45	1.45	15 10 40.9	1043.9	0 21.6	1.960 353	4559	4.49	3 28.5
28	15 44 25.07	− 8.07	− 1.48	+15 28 04.8	+1042.0	+0 21.6	1.955 794	− 4366	4.50	3 24.5
29	15 44 17.00	9.68	1.51	15 45 26.8	1039.7	0 21.6	1.951 428	4172	4.51	3 20.4
30	15 44 07.32	11.27	1.53	16 02 46.5	1036.7	0 21.6	1.947 256	3975	4.52	3 16.3
31	15 43 56.05	12.86	1.56	16 20 03.2	1033.2	0 21.6	1.943 281	3777	4.53	3 12.2
Apr. 1	15 43 43.19	14.43	1.59	16 37 16.4	1028.9	0 21.6	1.939 504	3576	4.54	3 08.0
2	15 43 28.76	− 16.00	− 1.61	+16 54 25.3	+1024.1	+0 21.5	1.935 928	− 3374	4.55	3 03.9
3	15 43 12.76		− 1.64	+17 11 29.4		+0 21.5	1.932 554		4.55	2 59.7

Approximate magnitude = 8.1

FOR 0^h UNIVERSAL TIME

Date	Apparent Right Ascension		Red. to Astrom. Place	Apparent Declination		Red. to Astrom. Place	True Distance from Earth		Hor. Parallax	Transit, Meridian of Greenwich
	h m s	s	s	° ′ ″	″	′ ″			″	h m
Apr. 3	15 43 12.76	− 17.54	− 1.64	+17 11 29.4	+1018.8	+0 21.5	1.932 554	− 3169	4.55	2 59.7
4	15 42 55.22	19.09	1.67	17 28 28.2	1012.8	0 21.4	1.929 385	2963	4.56	2 55.4
5	15 42 36.13	20.61	1.69	17 45 21.0	1006.1	0 21.4	1.926 422	2756	4.57	2 51.2
6	15 42 15.52	22.11	1.72	18 02 07.1	998.8	0 21.3	1.923 666	2546	4.57	2 46.9
7	15 41 53.41	23.61	1.75	18 18 45.9	990.9	0 21.2	1.921 120	2334	4.58	2 42.6
8	15 41 29.80	− 25.07	− 1.77	+18 35 16.8	+ 982.3	+0 21.2	1.918 786	− 2121	4.59	2 38.3
9	15 41 04.73	26.52	1.80	18 51 39.1	973.0	0 21.1	1.916 665	1905	4.59	2 33.9
10	15 40 38.21	27.95	1.82	19 07 52.1	963.1	0 21.0	1.914 760	1688	4.60	2 29.6
11	15 40 10.26	29.34	1.85	19 23 55.2	952.5	0 20.9	1.913 072	1470	4.60	2 25.2
12	15 39 40.92	30.70	1.87	19 39 47.7	941.2	0 20.8	1.911 602	1249	4.60	2 20.8
13	15 39 10.22	− 32.04	− 1.90	+19 55 28.9	+ 929.2	+0 20.7	1.910 353	− 1028	4.61	2 16.3
14	15 38 38.18	33.35	1.92	20 10 58.1	916.6	0 20.6	1.909 325	806	4.61	2 11.8
15	15 38 04.83	34.60	1.95	20 26 14.7	903.3	0 20.4	1.908 519	582	4.61	2 07.3
16	15 37 30.23	35.83	1.97	20 41 18.0	889.5	0 20.3	1.907 937	358	4.61	2 02.8
17	15 36 54.40	37.02	1.99	20 56 07.5	874.9	0 20.2	1.907 579	− 133	4.61	1 58.3
18	15 36 17.38	− 38.16	− 2.02	+21 10 42.4	+ 859.8	+0 20.0	1.907 446	+ 92	4.61	1 53.8
19	15 35 39.22	39.26	2.04	21 25 02.2	844.0	0 19.8	1.907 538	319	4.61	1 49.2
20	15 34 59.96	40.32	2.06	21 39 06.2	827.8	0 19.7	1.907 857	544	4.61	1 44.6
21	15 34 19.64	41.33	2.09	21 52 54.0	810.9	0 19.5	1.908 401	771	4.61	1 40.0
22	15 33 38.31	42.28	2.11	22 06 24.9	793.5	0 19.4	1.909 172	996	4.61	1 35.4
23	15 32 56.03	− 43.19	− 2.13	+22 19 38.4	+ 775.6	+0 19.2	1.910 168	+ 1222	4.61	1 30.8
24	15 32 12.84	44.05	2.15	22 32 34.0	757.3	0 19.0	1.911 390	1448	4.60	1 26.1
25	15 31 28.79	44.86	2.17	22 45 11.3	738.4	0 18.8	1.912 838	1672	4.60	1 21.5
26	15 30 43.93	45.60	2.19	22 57 29.7	719.2	0 18.6	1.914 510	1896	4.60	1 16.8
27	15 29 58.33	46.31	2.21	23 09 28.9	699.5	0 18.4	1.916 406	2119	4.59	1 12.1
28	15 29 12.02	− 46.96	− 2.23	+23 21 08.4	+ 679.5	+0 18.2	1.918 525	+ 2340	4.59	1 07.4
29	15 28 25.06	47.55	2.25	23 32 27.9	659.2	0 18.0	1.920 865	2562	4.58	1 02.7
30	15 27 37.51	48.08	2.27	23 43 27.1	638.5	0 17.8	1.923 427	2781	4.58	0 58.0
May 1	15 26 49.43	48.58	2.28	23 54 05.6	617.5	0 17.6	1.926 208	3000	4.57	0 53.2
2	15 26 00.85	49.01	2.30	24 04 23.1	596.3	0 17.3	1.929 208	3217	4.56	0 48.5
3	15 25 11.84	− 49.39	− 2.32	+24 14 19.4	+ 574.8	+0 17.1	1.932 425	+ 3433	4.55	0 43.8
4	15 24 22.45	49.72	2.33	24 23 54.2	553.0	0 16.9	1.935 858	3648	4.55	0 39.0
5	15 23 32.73	49.99	2.35	24 33 07.2	531.1	0 16.7	1.939 506	3862	4.54	0 34.3
6	15 22 42.74	50.20	2.36	24 41 58.3	508.9	0 16.4	1.943 368	4075	4.53	0 29.5
7	15 21 52.54	50.37	2.38	24 50 27.2	486.5	0 16.1	1.947 443	4286	4.52	0 24.7
8	15 21 02.17	− 50.47	− 2.39	+24 58 33.7	+ 464.0	+0 15.9	1.951 729	+ 4496	4.51	0 20.0
9	15 20 11.70	50.52	2.40	25 06 17.7	441.2	0 15.7	1.956 225	4704	4.50	0 15.2
10	15 19 21.18	50.51	2.42	25 13 38.9	418.4	0 15.4	1.960 929	4911	4.49	0 10.4
11	15 18 30.67	50.44	2.43	25 20 37.3	395.5	0 15.2	1.965 840	5116	4.48	0 05.7
12	15 17 40.23	50.31	2.44	25 27 12.8	372.4	0 14.9	1.970 956	5319	4.46	{0 00.9 23 56.1
13	15 16 49.92	− 50.13	− 2.45	+25 33 25.2	+ 349.5	+0 14.7	1.976 275	+ 5520	4.45	23 51.4
14	15 15 59.79	49.88	2.46	25 39 14.7	326.4	0 14.4	1.981 795	5719	4.44	23 46.6
15	15 15 09.91	49.59	2.47	25 44 41.1	303.3	0 14.2	1.987 514	5916	4.43	23 41.8
16	15 14 20.32	49.23	2.48	25 49 44.4	280.4	0 13.9	1.993 430	6111	4.41	23 37.1
17	15 13 31.09	48.82	2.49	25 54 24.8	257.5	0 13.7	1.999 541	6302	4.40	23 32.4
18	15 12 42.27	− 48.36	− 2.49	+25 58 42.3	+ 234.7	+0 13.4	2.005 843	+ 6493	4.39	23 27.6
19	15 11 53.91		− 2.50	+26 02 37.0		+0 13.2	2.012 336		4.37	23 22.9

Approximate magnitude = 8.1

PALLAS, 1950

FOR 0^h UNIVERSAL TIME

Date	Apparent Right Ascension		Red. to Astrom. Place	Apparent Declination		Red. to Astrom. Place	True Distance from Earth		Hor. Parallax	Transit, Meridian of Greenwich
	h m s	s	s	° ′ ″	″	′ ″			″	h m
May 19	15 11 53.91	− 47.84	− 2.50	+26 02 37.0	+ 212.0	+0 13.2	2.012 336	+ 6679	4.37	23 22.9
20	15 11 06.07	47.28	2.51	26 06 09.0	189.5	0 12.9	2.019 015	6863	4.36	23 18.2
21	15 10 18.79	46.66	2.51	26 09 18.5	167.2	0 12.7	2.025 878	7044	4.34	23 13.5
22	15 09 32.13	45.99	2.52	26 12 05.7	145.0	0 12.4	2.032 922	7223	4.33	23 08.8
23	15 08 46.14	45.28	2.52	26 14 30.7	123.1	0 12.2	2.040 145	7399	4.31	23 04.1
24	15 08 00.86	− 44.53	− 2.52	+26 16 33.8	+ 101.5	+0 11.9	2.047 544	+ 7572	4.30	22 59.4
25	15 07 16.33	43.73	2.53	26 18 15.3	80.0	0 11.7	2.055 116	7741	4.28	22 54.8
26	15 06 32.60	42.89	2.53	26 19 35.3	58.9	0 11.4	2.062 857	7908	4.27	22 50.1
27	15 05 49.71	42.01	2.53	26 20 34.2	38.1	0 11.2	2.070 765	8072	4.25	22 45.5
28	15 05 07.70	41.11	2.53	26 21 12.3	+ 17.6	0 11.0	2.078 837	8232	4.23	22 40.9
29	15 04 26.59	− 40.17	− 2.53	+26 21 29.9	− 2.5	+0 10.7	2.087 069	+ 8391	4.22	22 36.3
30	15 03 46.42	39.19	2.53	26 21 27.4	22.5	0 10.5	2.095 460	8545	4.20	22 31.7
31	15 03 07.23	38.19	2.53	26 21 04.9	41.9	0 10.3	2.104 005	8698	4.18	22 27.1
June 1	15 02 29.04	37.16	2.53	26 20 23.0	61.2	0 10.0	2.112 703	8848	4.17	22 22.6
2	15 01 51.88	36.11	2.53	26 19 21.8	80.1	0 09.8	2.121 551	8995	4.15	22 18.1
3	15 01 15.77	− 35.02	− 2.53	+26 18 01.7	− 98.6	+0 09.6	2.130 546	+ 9139	4.13	22 13.6
4	15 00 40.75	33.92	2.53	26 16 23.1	116.9	0 09.4	2.139 685	9282	4.11	22 09.1
5	15 00 06.83	32.79	2.53	26 14 26.2	134.9	0 09.2	2.148 967	9421	4.09	22 04.6
6	14 59 34.04	31.63	2.52	26 12 11.3	152.4	0 09.0	2.158 388	9558	4.08	22 00.1
7	14 59 02.41	30.46	2.52	26 09 38.9	169.7	0 08.8	2.167 946	9692	4.06	21 55.7
8	14 58 31.95	− 29.26	− 2.52	+26 06 49.2	− 186.5	+0 08.6	2.177 638	+ 9823	4.04	21 51.3
9	14 58 02.69	28.05	2.51	26 03 42.7	203.2	0 08.4	2.187 461	9952	4.02	21 46.9
10	14 57 34.64	26.81	2.51	26 00 19.5	219.3	0 08.2	2.197 413	10078	4.00	21 42.5
11	14 57 07.83	25.56	2.50	25 56 40.2	235.1	0 08.0	2.207 491	10201	3.99	21 38.1
12	14 56 42.27	24.29	2.50	25 52 45.1	250.6	0 07.8	2.217 692	10320	3.97	21 33.8
13	14 56 17.98	− 23.02	− 2.49	+25 48 34.5	− 265.7	+0 07.6	2.228 012	+10438	3.95	21 29.5
14	14 55 54.96	21.72	2.49	25 44 08.8	280.4	0 07.5	2.238 450	10552	3.93	21 25.2
15	14 55 33.24	20.42	2.48	25 39 28.4	294.7	0 07.3	2.249 002	10663	3.91	21 20.9
16	14 55 12.82	19.11	2.48	25 34 33.7	308.6	0 07.1	2.259 665	10771	3.89	21 16.7
17	14 54 53.71	17.80	2.47	25 29 25.1	322.2	0 07.0	2.270 436	10877	3.88	21 12.4
18	14 54 35.91	− 16.46	− 2.46	+25 24 02.9	− 335.3	+0 06.8	2.281 313	+10978	3.86	21 08.2
19	14 54 19.45	15.13	2.45	25 18 27.6	348.2	0 06.6	2.292 291	11078	3.84	21 04.0
20	14 54 04.32	13.80	2.45	25 12 39.4	360.5	0 06.5	2.303 369	11174	3.82	20 59.9
21	14 53 50.52	12.47	2.44	25 06 38.9	372.5	0 06.4	2.314 543	11267	3.80	20 55.7
22	14 53 38.05	11.13	2.43	25 00 26.4	384.0	0 06.2	2.325 810	11357	3.78	20 51.6
23	14 53 26.92	− 9.79	− 2.42	+24 54 02.4	− 395.3	+0 06.1	2.337 167	+11444	3.77	20 47.5
24	14 53 17.13	8.46	2.41	24 47 27.1	406.2	0 05.9	2.348 611	11529	3.75	20 43.4
25	14 53 08.67	7.14	2.40	24 40 40.9	416.6	0 05.8	2.360 140	11610	3.73	20 39.4
26	14 53 01.53	5.82	2.40	24 33 44.3	426.7	0 05.7	2.371 750	11690	3.71	20 35.4
27	14 52 55.71	4.50	2.39	24 26 37.6	436.5	0 05.6	2.383 440	11766	3.69	20 31.4
28	14 52 51.21	− 3.19	− 2.38	+24 19 21.1	− 445.9	+0 05.5	2.395 206	+11841	3.67	20 27.4
29	14 52 48.02	1.89	2.37	24 11 55.2	455.0	0 05.4	2.407 047	11913	3.66	20 23.4
30	14 52 46.13	− 0.60	2.36	24 04 20.2	463.7	0 05.3	2.418 960	11982	3.64	20 19.5
July 1	14 52 45.53	+ 0.68	2.35	23 56 36.5	472.3	0 05.2	2.430 942	12050	3.62	20 15.5
2	14 52 46.21	1.96	2.34	23 48 44.2	480.5	0 05.1	2.442 992	12116	3.60	20 11.6
3	14 52 48.17	+ 3.24	− 2.33	+23 40 43.7	− 488.4	+0 05.0	2.455 108	+12179	3.58	20 07.7
4	14 52 51.41		2.32	+23 32 35.3		0 04.9	2.467 287		3.57	20 03.9

Approximate magnitude = 8.5

FOR 0^h UNIVERSAL TIME

Date	Apparent Right Ascension		Red. to Astrom. Place	Apparent Declination		Red. to Astrom. Place	True Distance from Earth		Hor. Parallax	Transit, Meridian of Greenwich
	h m s	s	s	° ′ ″	″	′ ″			″	h m
July 4	14 52 51.41	+ 4.49	− 2.32	+23 32 35.3	− 496.0	+0 04.9	2.467 287	+12240	3.57	20 03.9
5	14 52 55.90	5.76	2.31	23 24 19.3	503.4	0 04.8	2.479 527	12300	3.55	20 00.0
6	14 53 01.66	7.00	2.30	23 15 55.9	510.4	0 04.7	2.491 827	12356	3.53	19 56.2
7	14 53 08.66	8.24	2.29	23 07 25.5	517.3	0 04.6	2.504 183	12410	3.51	19 52.4
8	14 53 16.90	9.47	2.28	22 58 48.2	523.8	0 04.5	2.516 593	12462	3.50	19 48.7
9	14 53 26.37	+ 10.70	− 2.27	+22 50 04.4	− 530.1	+0 04.5	2.529 055	+12513	3.48	19 44.9
10	14 53 37.07	11.91	2.26	22 41 14.3	536.2	0 04.4	2.541 568	12560	3.46	19 41.2
11	14 53 48.98	13.12	2.25	22 32 18.1	541.8	0 04.3	2.554 128	12605	3.45	19 37.4
12	14 54 02.10	14.32	2.24	22 23 16.3	547.4	0 04.3	2.566 733	12648	3.43	19 33.7
13	14 54 16.42	15.50	2.23	22 14 08.9	552.6	0 04.2	2.579 381	12688	3.41	19 30.1
14	14 54 31.92	+ 16.68	− 2.22	+22 04 56.3	− 557.6	+0 04.1	2.592 069	+12726	3.39	19 26.4
15	14 54 48.60	17.84	2.21	21 55 38.7	562.3	0 04.1	2.604 795	12762	3.38	19 22.8
16	14 55 06.44	18.99	2.20	21 46 16.4	566.8	0 04.1	2.617 557	12796	3.36	19 19.1
17	14 55 25.43	20.14	2.19	21 36 49.6	571.0	0 04.0	2.630 353	12827	3.35	19 15.5
18	14 55 45.57	21.27	2.18	21 27 18.6	574.9	0 04.0	2.643 180	12855	3.33	19 12.0
19	14 56 06.84	+ 22.38	− 2.17	+21 17 43.7	− 578.8	+0 03.9	2.656 035	+12881	3.31	19 08.4
20	14 56 29.22	23.49	2.15	21 08 04.9	582.2	0 03.9	2.668 916	12906	3.30	19 04.8
21	14 56 52.71	24.58	2.14	20 58 22.7	585.5	0 03.8	2.681 822	12928	3.28	19 01.3
22	14 57 17.29	25.65	2.13	20 48 37.2	588.5	0 03.8	2.694 750	12947	3.27	18 57.8
23	14 57 42.94	26.72	2.12	20 38 48.7	591.4	0 03.8	2.707 697	12965	3.25	18 54.3
24	14 58 09.66	+ 27.76	− 2.11	+20 28 57.3	− 594.0	+0 03.8	2.720 662	+12982	3.23	18 50.8
25	14 58 37.42	28.80	2.10	20 19 03.3	596.4	0 03.7	2.733 644	12995	3.22	18 47.4
26	14 59 06.22	29.81	2.09	20 09 06.9	598.6	0 03.7	2.746 639	13008	3.20	18 43.9
27	14 59 36.03	30.81	2.08	19 59 08.3	600.8	0 03.7	2.759 647	13019	3.19	18 40.5
28	15 00 06.84	31.81	2.07	19 49 07.5	602.6	0 03.7	2.772 666	13029	3.17	18 37.1
29	15 00 38.65	+ 32.78	− 2.06	+19 39 04.9	− 604.3	+0 03.7	2.785 695	+13037	3.16	18 33.7
30	15 01 11.43	33.74	2.05	19 29 00.6	606.0	0 03.7	2.798 732	13043	3.14	18 30.3
31	15 01 45.17	34.70	2.04	19 18 54.6	607.4	0 03.7	2.811 775	13048	3.13	18 27.0
Aug. 1	15 02 19.87	35.64	2.02	19 08 47.2	608.7	0 03.7	2.824 823	13051	3.12	18 23.6
2	15 02 55.51	36.57	2.01	18 58 38.5	609.9	0 03.6	2.837 874	13053	3.10	18 20.3
3	15 03 32.08	+ 37.48	− 2.00	+18 48 28.6	− 610.9	+0 03.6	2.850 927	+13054	3.09	18 17.0
4	15 04 09.56	38.39	1.99	18 38 17.7	611.8	0 03.6	2.863 981	13052	3.07	18 13.7
5	15 04 47.95	39.30	1.98	18 28 05.9	612.5	0 03.6	2.877 033	13049	3.06	18 10.4
6	15 05 27.25	40.18	1.97	18 17 53.4	613.1	0 03.6	2.890 082	13044	3.04	18 07.1
7	15 06 07.43	41.06	1.96	18 07 40.3	613.5	0 03.6	2.903 126	13037	3.03	18 03.9
8	15 06 48.49	+ 41.92	− 1.95	+17 57 26.8	− 613.9	+0 03.6	2.916 163	+13029	3.02	18 00.6
9	15 07 30.41	42.78	1.94	17 47 12.9	614.1	0 03.7	2.929 192	13020	3.00	17 57.4
10	15 08 13.19	43.63	1.93	17 36 58.8	614.1	0 03.7	2.942 212	13007	2.99	17 54.2
11	15 08 56.82	44.46	1.92	17 26 44.7	614.0	0 03.7	2.955 219	12994	2.98	17 51.0
12	15 09 41.28	45.28	1.91	17 16 30.7	613.8	0 03.7	2.968 213	12979	2.96	17 47.8
13	15 10 26.56	+ 46.10	− 1.89	+17 06 16.9	− 613.5	+0 03.7	2.981 192	+12961	2.95	17 44.6
14	15 11 12.66	46.91	1.88	16 56 03.4	612.9	0 03.7	2.994 153	12943	2.94	17 41.5
15	15 11 59.57	47.70	1.87	16 45 50.5	612.3	0 03.7	3.007 096	12921	2.93	17 38.3
16	15 12 47.27	48.48	1.86	16 35 38.2	611.5	0 03.8	3.020 017	12899	2.91	17 35.2
17	15 12 35.75		− 1.85	+16 25 26.7		+0 03.8	3.032 916		2.90	17 32.1

Approximate magnitude = 9.0

FOR 0^h UNIVERSAL TIME

Date	Apparent Right Ascension		Red. to Astrom. Place	Apparent Declination		Red. to Astrom. Place	True Distance from Earth		Hor. Parallax	Transit, Meridian of Greenwich
	h m s	s	s	° ′ ″	″	′ ″			″	h m
Feb. 1	16 20 16.64	+ 80.11	+ 0.50	−15 53 14.5	− 225.6	+0 08.8	2.945 795	−11550	2.99	7 36.9
2	16 21 36.75	79.52	0.47	15 57 00.1	221.7	0 09.0	2.934 245	11614	3.00	7 34.3
3	16 22 56.27	78.94	0.44	16 00 41.8	217.8	0 09.1	2.922 631	11678	3.01	7 31.7
4	16 24 15.21	78.33	0.42	16 04 19.6	213.9	0 09.2	2.910 953	11740	3.02	7 29.1
5	16 25 33.54	77.72	0.39	16 07 53.5	210.2	0 09.3	2.899 213	11801	3.04	7 26.5
6	16 26 51.26	+ 77.09	+ 0.36	−16 11 23.7	− 206.4	+0 09.4	2.887 412	−11860	3.05	7 23.8
7	16 28 08.35	76.45	0.34	16 14 50.1	202.7	0 09.6	2.875 552	11919	3.06	7 21.2
8	16 29 24.80	75.80	0.31	16 18 12.8	198.9	0 09.7	2.863 633	11977	3.07	7 18.5
9	16 30 40.60	75.12	0.28	16 21 31.7	195.3	0 09.8	2.851 656	12032	3.09	7 15.8
10	16 31 55.72	74.43	0.25	16 24 47.0	191.6	0 09.9	2.839 624	12087	3.10	7 13.1
11	16 33 10.15	+ 73.73	+ 0.23	−16 27 58.6	− 188.1	+0 10.0	2.827 537	−12139	3.11	7 10.4
12	16 34 23.88	73.02	0.20	16 31 06.7	184.5	0 10.1	2.815 398	12189	3.13	7 07.7
13	16 35 36.90	72.29	0.17	16 34 11.2	181.0	0 10.2	2.803 209	12238	3.14	7 05.0
14	16 36 49.19	71.53	0.15	16 37 12.2	177.6	0 10.3	2.790 971	12285	3.15	7 02.2
15	16 38 00.72	70.78	0.12	16 40 09.8	174.2	0 10.4	2.778 686	12329	3.17	6 59.5
16	16 39 11.50	+ 69.99	+ 0.09	−16 43 04.0	− 170.9	+0 10.5	2.766 357	−12372	3.18	6 56.7
17	16 40 21.49	69.20	0.06	16 45 54.9	167.5	0 10.6	2.753 985	12412	3.20	6 54.0
18	16 41 30.69	68.39	0.03	16 48 42.4	164.4	0 10.6	2.741 573	12449	3.21	6 51.2
19	16 42 39.08	67.57	+ 0.01	16 51 26.8	161.2	0 10.7	2.729 124	12485	3.22	6 48.4
20	16 43 46.65	66.74	− 0.02	16 54 08.0	158.1	0 10.8	2.716 639	12519	3.24	6 45.6
21	16 44 53.39	+ 65.88	− 0.05	−16 56 46.1	− 155.1	+0 10.9	2.704 120	−12549	3.25	6 42.7
22	16 45 59.27	65.01	0.08	16 59 21.2	152.1	0 11.0	2.691 571	12578	3.27	6 39.9
23	16 47 04.28	64.14	0.10	17 01 53.3	149.2	0 11.1	2.678 993	12604	3.28	6 37.0
24	16 48 08.42	63.24	0.13	17 04 22.5	146.4	0 11.1	2.666 389	12629	3.30	6 34.2
25	16 49 11.66	62.33	0.16	17 06 48.9	143.6	0 11.2	2.653 760	12651	3.32	6 31.3
26	16 50 13.99	+ 61.41	− 0.19	−17 09 12.5	− 140.9	+0 11.3	2.641 109	−12670	3.33	6 28.4
27	16 51 15.40	60.48	0.21	17 11 33.4	138.3	0 11.3	2.628 439	12688	3.35	6 25.4
28	16 52 15.88	59.52	0.24	17 13 51.7	135.7	0 11.4	2.615 751	12703	3.36	6 22.5
Mar. 1	16 53 15.40	58.56	0.27	17 16 07.4	133.3	0 11.4	2.603 048	12716	3.38	6 19.6
2	16 54 13.96	57.58	0.30	17 18 20.7	130.8	0 11.5	2.590 332	12727	3.40	6 16.6
3	16 55 11.54	+ 56.59	− 0.33	−17 20 31.5	− 128.5	+0 11.6	2.577 605	−12736	3.41	6 13.6
4	16 56 08.13	55.58	0.36	17 22 40.0	126.2	0 11.6	2.564 869	12743	3.43	6 10.6
5	16 57 03.71	54.55	0.38	17 24 46.2	124.0	0 11.7	2.552 126	12748	3.45	6 07.6
6	16 57 58.26	53.51	0.41	17 26 50.2	121.8	0 11.7	2.539 378	12751	3.47	6 04.6
7	16 58 51.77	52.45	0.44	17 28 52.0	119.7	0 11.8	2.526 627	12752	3.48	6 01.5
8	16 59 44.22	+ 51.37	− 0.47	−17 30 51.7	− 117.7	+0 11.8	2.513 875	−12750	3.50	5 58.5
9	17 00 35.59	50.28	0.50	17 32 49.4	115.7	0 11.9	2.501 125	12747	3.52	5 55.4
10	17 01 25.87	49.16	0.53	17 34 45.1	113.8	0 11.9	2.488 378	12740	3.54	5 52.3
11	17 02 15.03	48.02	0.55	17 36 38.9	111.9	0 12.0	2.475 638	12731	3.55	5 49.2
12	17 03 03.05	46.86	0.58	17 38 30.8	110.2	0 12.0	2.462 907	12720	3.57	5 46.0
13	17 03 49.91	+ 45.70	− 0.61	−17 40 21.0	− 108.5	+0 12.0	2.450 187	−12704	3.59	5 42.9
14	17 04 35.61	44.50	0.64	17 42 09.5	106.9	0 12.1	2.437 483	12687	3.61	5 39.7
15	17 05 20.11	43.29	0.67	17 43 56.4	105.3	0 12.1	2.424 796	12666	3.63	5 36.5
16	17 06 03.40	42.06	0.70	17 45 41.7	103.9	0 12.1	2.412 130	12642	3.65	5 33.3
17	17 06 45.46	40.81	0.73	17 47 25.6	102.5	0 12.1	2.399 488	12615	3.67	5 30.0
18	17 07 26.27	+ 39.55	− 0.76	−17 49 08.1	− 101.2	+0 12.2	2.386 873	−12584	3.69	5 26.8
19	17 08 05.82		− 0.79	−17 50 49.3		+0 12.2	2.374 289		3.71	5 23.5

Approximate magnitude = 8.3

FOR 0^h UNIVERSAL TIME

Date	Apparent Right Ascension		Red. to Astrom. Place	Apparent Declination		Red. to Astrom. Place	True Distance from Earth		Hor. Paral-lax	Transit, Meridian of Green-wich
	h m s	s	s	° ′ ″	″	′ ″			″	h m
Mar. 19	17 08 05.82	+ 38.27	− 0.79	−17 50 49.3	− 100.0	+0 12.2	2.374 289	−12551	3.71	5 23.5
20	17 08 44.09	36.97	0.82	17 52 29.3	98.8	0 12.2	2.361 738	12513	3.73	5 20.2
21	17 09 21.06	35.65	0.84	17 54 08.1	97.8	0 12.2	2.349 225	12472	3.75	5 16.9
22	17 09 56.71	34.32	0.87	17 55 45.9	96.7	0 12.2	2.336 753	12429	3.77	5 13.5
23	17 10 31.03	32.98	0.90	17 57 22.6	95.9	0 12.3	2.324 324	12382	3.79	5 10.1
24	17 11 04.01	+ 31.62	− 0.93	−17 58 58.5	− 95.1	+0 12.3	2.311 942	−12331	3.81	5 06.7
25	17 11 35.63	30.24	0.96	18 00 33.6	94.3	0 12.3	2.299 611	12277	3.83	5 03.3
26	17 12 05.87	28.86	0.99	18 02 07.9	93.6	0 12.3	2.287 334	12220	3.85	4 59.9
27	17 12 34.73	27.45	1.02	18 03 41.5	93.1	0 12.3	2.275 114	12160	3.87	4 56.4
28	17 13 02.18	26.03	1.05	18 05 14.6	92.5	0 12.3	2.262 954	12096	3.89	4 53.0
29	17 13 28.21	+ 24.60	− 1.08	−18 06 47.1	− 92.1	+0 12.3	2.250 858	−12029	3.91	4 49.5
30	17 13 52.81	23.15	1.11	18 08 19.2	91.6	0 12.3	2.238 829	11959	3.93	4 45.9
31	17 14 15.96	21.70	1.14	18 09 50.8	91.4	0 12.3	2.226 870	11885	3.95	4 42.4
Apr. 1	17 14 37.66	20.23	1.17	18 11 22.2	91.1	0 12.3	2.214 985	11809	3.97	4 38.8
2	17 14 57.89	18.74	1.20	18 12 53.3	90.9	0 12.3	2.203 176	11729	3.99	4 35.2
3	17 15 16.63	+ 17.24	− 1.23	−18 14 24.2	− 90.8	+0 12.3	2.191 447	−11647	4.02	4 31.6
4	17 15 33.87	15.72	1.26	18 15 55.0	90.6	0 12.3	2.179 800	11561	4.04	4 27.9
5	17 15 49.59	14.19	1.29	18 17 25.6	90.7	0 12.3	2.168 239	11471	4.06	4 24.2
6	17 16 03.78	12.65	1.32	18 18 56.3	90.6	0 12.3	2.156 768	11378	4.08	4 20.5
7	17 16 16.43	11.09	1.35	18 20 26.9	90.7	0 12.3	2.145 390	11282	4.10	4 16.8
8	17 16 27.52	+ 9.51	− 1.37	−18 21 57.6	− 90.9	+0 12.3	2.134 108	−11181	4.12	4 13.1
9	17 16 37.03	7.92	1.40	18 23 28.5	91.0	0 12.3	2.122 927	11076	4.15	4 09.3
10	17 16 44.95	6.32	1.43	18 24 59.5	91.2	0 12.3	2.111 851	10968	4.17	4 05.5
11	17 16 51.27	4.71	1.46	18 26 30.7	91.5	0 12.3	2.100 883	10854	4.19	4 01.7
12	17 16 55.98	3.08	1.49	18 28 02.2	91.8	0 12.3	2.090 029	10738	4.21	3 57.8
13	17 16 59.06	+ 1.45	− 1.52	−18 29 34.0	− 92.2	+0 12.3	2.079 291	−10616	4.23	3 53.9
14	17 17 00.51	− 0.18	1.55	18 31 06.2	92.7	0 12.3	2.068 675	10490	4.25	3 50.0
15	17 17 00.33	1.83	1.58	18 32 38.9	93.1	0 12.3	2.058 185	10360	4.28	3 46.1
16	17 16 58.50	3.48	1.61	18 34 12.0	93.6	0 12.3	2.047 825	10225	4.30	3 42.1
17	17 16 55.02	5.13	1.64	18 35 45.6	94.1	0 12.3	2.037 600	10087	4.32	3 38.1
18	17 16 49.89	− 6.78	− 1.67	−18 37 19.7	− 94.7	+0 12.3	2.027 513	− 9943	4.34	3 34.1
19	17 16 43.11	8.44	1.70	18 38 54.4	95.4	0 12.3	2.017 570	9796	4.36	3 30.0
20	17 16 34.67	10.09	1.73	18 40 29.8	96.0	0 12.3	2.007 774	9644	4.38	3 25.9
21	17 16 24.58	11.74	1.75	18 42 05.8	96.7	0 12.3	1.998 130	9488	4.40	3 21.8
22	17 16 12.84	13.38	1.78	18 43 42.5	97.4	0 12.3	1.988 642	9328	4.43	3 17.7
23	17 15 59.46	− 15.02	− 1.81	−18 45 19.9	− 98.1	+0 12.3	1.979 314	− 9163	4.45	3 13.6
24	17 15 44.44	16.66	1.84	18 46 58.0	98.8	0 12.3	1.970 151	8994	4.47	3 09.4
25	17 15 27.78	18.28	1.87	18 48 36.8	99.6	0 12.3	1.961 157	8822	4.49	3 05.2
26	17 15 09.50	19.90	1.90	18 50 16.4	100.4	0 12.3	1.952 335	8646	4.51	3 00.9
27	17 14 49.60	21.50	1.92	18 51 56.8	101.0	0 12.3	1.943 689	8466	4.53	2 56.7
28	17 14 28.10	− 23.09	− 1.95	−18 53 37.8	− 101.9	+0 12.3	1.935 223	− 8281	4.55	2 52.4
29	17 14 05.01	24.66	1.98	18 55 19.7	102.6	0 12.3	1.926 942	8094	4.57	2 48.1
30	17 13 40.35	26.22	2.01	18 57 02.3	103.3	0 12.3	1.918 848	7903	4.59	2 43.7
May 1	17 13 14.13	27.78	2.03	18 58 45.6	104.1	0 12.3	1.910 945	7708	4.61	2 39.3
2	17 12 46.35	29.30	2.06	19 00 29.7	104.7	0 12.3	1.903 237	7510	4.62	2 34.9
3	17 12 17.05	− 30.82	− 2.09	−19 02 14.4	− 105.4	+0 12.3	1.895 727	− 7307	4.64	2 30.5
4	17 11 46.23		− 2.11	−19 03 59.8		+0 12.3	1.888 420		4.66	2 26.1

Approximate magnitude = 7.8

FOR 0^h UNIVERSAL TIME

Date	Apparent Right Ascension		Red. to Astrom. Place	Apparent Declination		Red. to Astrom. Place	True Distance from Earth		Hor. Parallax	Transit, Meridian of Greenwich
	h m s	s	s	° ′ ″	″	′ ″			″	h m
May 4	17 11 46.23	− 32.32	− 2.11	−19 03 59.8	− 106.1	+0 12.3	1.888 420	− 7101	4.66	2 26.1
5	17 11 13.91	33.80	2.14	19 05 45.9	106.6	0 12.3	1.881 319	6892	4.68	2 21.6
6	17 10 40.11	35.26	2.17	19 07 32.5	107.3	0 12.3	1.874 427	6678	4.69	2 17.1
7	17 10 04.85	36.69	2.19	19 09 19.8	107.8	0 12.4	1.867 749	6460	4.71	2 12.6
8	17 09 28.16	38.09	2.22	19 11 07.6	108.4	0 12.4	1.861 289	6238	4.73	2 08.1
9	17 08 50.07	− 39.46	− 2.24	−19 12 56.0	− 108.9	+0 12.4	1.855 051	− 6012	4.74	2 03.5
10	17 08 10.61	40.81	2.27	19 14 44.9	109.4	0 12.4	1.849 039	5783	4.76	1 58.9
11	17 07 29.80	42.12	2.29	19 16 34.3	109.9	0 12.4	1.843 256	5549	4.77	1 54.3
12	17 06 47.68	43.40	2.31	19 18 24.2	110.3	0 12.4	1.837 707	5312	4.79	1 49.7
13	17 06 04.28	44.62	2.34	19 20 14.5	110.7	0 12.4	1.832 395	5072	4.80	1 45.0
14	17 05 19.66	− 45.82	− 2.36	−19 22 05.2	− 111.2	+0 12.4	1.827 323	− 4827	4.82	1 40.3
15	17 04 33.84	46.96	2.38	19 23 56.4	111.5	0 12.5	1.822 496	4580	4.83	1 35.6
16	17 03 46.88	48.05	2.41	19 25 47.9	111.8	0 12.5	1.817 916	4329	4.84	1 30.9
17	17 02 58.83	49.11	2.43	19 27 39.7	112.2	0 12.5	1.813 587	4075	4.85	1 26.2
18	17 02 09.72	50.11	2.45	19 29 31.9	112.4	0 12.5	1.809 512	3819	4.86	1 21.5
19	17 01 19.61	− 51.06	− 2.47	−19 31 24.3	− 112.6	+0 12.6	1.805 693	− 3560	4.87	1 16.7
20	17 00 28.55	51.95	2.49	19 33 16.9	112.9	0 12.6	1.802 133	3298	4.88	1 11.9
21	16 59 36.60	52.79	2.51	19 35 09.8	113.1	0 12.6	1.798 835	3034	4.89	1 07.1
22	16 58 43.81	53.57	2.53	19 37 02.9	113.3	0 12.7	1.795 801	2769	4.90	1 02.3
23	16 57 50.24	54.29	2.55	19 38 56.2	113.4	0 12.7	1.793 032	2501	4.91	0 57.5
24	16 56 55.95	− 54.96	− 2.57	−19 40 49.6	− 113.6	+0 12.7	1.790 531	− 2232	4.91	0 52.7
25	16 56 00.99	55.56	2.59	19 42 43.2	113.6	0 12.8	1.788 299	1961	4.92	0 47.8
26	16 55 05.43	56.10	2.61	19 44 36.8	113.7	0 12.8	1.786 338	1690	4.93	0 43.0
27	16 54 09.33	56.58	2.62	19 46 30.5	113.8	0 12.9	1.784 648	1417	4.93	0 38.1
28	16 53 12.75	57.01	2.64	19 48 24.3	113.7	0 12.9	1.783 231	1144	4.93	0 33.1
29	16 52 15.74	− 57.36	− 2.66	−19 50 18.0	− 113.8	+0 13.0	1.782 087	− 869	4.94	0 28.4
30	16 51 18.38	57.67	2.67	19 52 11.8	113.8	0 13.0	1.781 218	595	4.94	0 23.5
31	16 50 20.71	57.92	2.69	19 54 05.6	113.7	0 13.0	1.780 623	320	4.94	0 18.6
June 1	16 49 22.79	58.10	2.70	19 55 59.3	113.7	0 13.1	1.780 303	− 44	4.94	0 13.7
2	16 48 24.69	58.22	2.71	19 57 53.0	113.7	0 13.1	1.780 259	+ 232	4.94	0 08.8
3	16 47 26.47	− 58.28	− 2.73	−19 59 46.7	− 113.6	+0 13.2	1.780 491	+ 509	4.94	{0 03.9 / 23 59.0}
4	16 46 28.19	58.28	2.74	20 01 40.3	113.6	0 13.2	1.781 000	786	4.94	23 54.1
5	16 45 29.91	58.22	2.75	20 03 33.9	113.5	0 13.3	1.781 786	1063	4.94	23 49.2
6	16 44 31.69	58.09	2.76	20 05 27.4	113.6	0 13.3	1.782 849	1340	4.94	23 44.3
7	16 43 33.60	57.91	2.77	20 07 21.0	113.6	0 13.4	1.784 189	1617	4.93	23 39.4
8	16 42 35.69	− 57.65	− 2.78	−20 09 14.6	− 113.6	+0 13.4	1.785 806	+ 1895	4.93	23 34.5
9	16 41 38.04	57.34	2.79	20 11 08.2	113.7	0 13.5	1.787 701	2171	4.92	23 29.7
10	16 40 40.70	56.96	2.80	20 13 01.9	113.9	0 13.5	1.789 872	2446	4.92	23 24.8
11	16 39 43.74	56.52	2.81	20 14 55.8	114.0	0 13.6	1.792 318	2721	4.91	23 19.9
12	16 38 47.22	56.02	2.82	20 16 49.8	114.2	0 13.7	1.795 039	2994	4.90	23 15.1
13	16 37 51.20	− 55.45	− 2.83	−20 18 44.0	− 114.6	+0 13.7	1.798 033	+ 3267	4.89	23 10.2
14	16 36 55.75	54.82	2.83	20 20 38.6	114.8	0 13.7	1.801 300	3537	4.89	23 05.4
15	16 36 00.93	54.14	2.84	20 22 33.4	115.1	0 13.8	1.804 837	3806	4.88	23 00.5
16	16 35 06.79	53.40	2.85	20 24 28.5	115.6	0 13.8	1.808 643	4072	4.87	22 55.7
17	16 34 13.39	52.60	2.85	20 26 24.1	116.1	0 13.9	1.812 715	4337	4.85	22 50.9
18	16 33 20.79	− 51.75	− 2.86	−20 28 20.2	− 116.6	+0 14.0	1.817 052	+ 4599	4.84	22 46.1
19	16 32 29.04		− 2.86	−20 30 16.8		+0 14.0	1.821 651		4.83	22 41.4

Approximate magnitude = 7.5

FOR 0^h UNIVERSAL TIME

Date	Apparent Right Ascension		Red. to Astron Place	Apparent Declination		Red. to Astrom. Place	True Distance from Earth		Hor. Paral-lax	Transit, Meridian of Green-wich
	h m s	s	s	° ′ ″	″	′ ″			″	h m
June 19	16 32 29.04	− 50.85	− 2.86	−20 30 16.8	− 117.2	+0 14.0	1.821 651	+ 4859	4.83	22 41.4
20	16 31 38.19	49.89	2.87	20 32 14.0	117.8	0 14.1	1.826 510	5115	4.82	22 36.6
21	16 30 48.30	48.89	2.87	20 34 11.8	118.5	0 14.1	1.831 625	5369	4.80	22 31.9
22	16 29 59.41	47.84	2.87	20 36 10.3	119.3	0 14.1	1.836 994	5619	4.79	22 27.1
23	16 29 11.57	46.75	2.87	20 38 09.6	120.1	0 14.2	1.842 613	5867	4.78	22 22.4
24	16 28 24.82	− 45.62	− 2.88	−20 40 09.7	− 121.0	+0 14.3	1.848 480	+ 6111	4.76	22 17.7
25	16 27 39.20	44.45	2.88	20 42 10.7	121.9	0 14.3	1.854 591	6351	4.74	22 13.1
26	16 26 54.75	43.25	2.88	20 44 12.6	122.8	0 14.4	1.860 942	6588	4.73	22 08.4
27	16 26 11.50	42.01	2.88	20 46 15.4	123.9	0 14.4	1.867 530	6821	4.71	22 03.8
28	16 25 29.49	40.74	2.88	20 48 19.3	124.9	0 14.4	1.874 351	7052	4.69	21 59.2
29	16 24 48.75	− 39.45	− 2.88	−20 50 24.2	− 126.0	+0 14.5	1.881 403	+ 7279	4.68	21 54.6
30	16 24 09.30	38.13	2.88	20 52 30.2	127.2	0 14.6	1.888 682	7502	4.66	21 50.0
July 1	16 23 31.17	36.78	2.88	20 54 37.4	128.4	0 14.6	1.896 184	7723	4.64	21 45.5
2	16 22 54.39	35.41	2.87	20 56 45.8	129.7	0 14.6	1.903 907	7939	4.62	21 41.0
3	16 22 18.98	34.01	2.87	20 58 55.5	130.9	0 14.7	1.911 846	8154	4.60	21 36.5
4	16 21 44.97	− 32.60	− 2.87	−21 01 06.4	− 132.3	+0 14.7	1.920 000	+ 8364	4.58	21 32.0
5	16 21 12.37	31.16	2.87	21 03 18.7	133.8	0 14.7	1.928 364	8572	4.56	21 27.5
6	16 20 41.21	29.69	2.86	21 05 32.5	135.2	0 14.8	1.936 936	8775	4.54	21 23.1
7	16 20 11.52	28.22	2.86	21 07 47.7	136.8	0 14.8	1.945 711	8975	4.52	21 18.7
8	16 19 43.30	26.72	2.86	21 10 04.5	138.3	0 14.8	1.954 686	9172	4.50	21 14.3
9	16 19 16.58	− 25.21	− 2.85	−21 12 22.8	− 139.9	+0 14.9	1.963 858	+ 9364	4.48	21 10.0
10	16 18 51.37	23.69	2.85	21 14 42.7	141.6	0 14.9	1.973 222	9553	4.46	21 05.7
11	16 18 27.68	22.14	2.84	21 17 04.3	143.2	0 14.9	1.982 775	9739	4.44	21 01.4
12	16 18 05.54	20.59	2.84	21 19 27.5	145.0	0 15.0	1.992 514	9919	4.42	20 57.1
13	16 17 44.95	19.03	2.84	21 21 52.5	146.8	0 15.0	2.002 433	10096	4.39	20 52.8
14	16 17 25.92	− 17.46	− 2.83	−21 24 19.3	− 148.5	+0 15.0	2.012 529	+10269	4.37	20 48.6
15	16 17 08.46	15.89	2.83	21 26 47.8	150.4	0 15.0	2.022 798	10438	4.35	20 44.4
16	16 16 52.57	14.30	2.82	21 29 18.2	152.1	0 15.1	2.033 236	10603	4.33	20 40.2
17	16 16 38.27	12.72	2.81	21 31 50.3	154.0	0 15.1	2.043 839	10762	4.31	20 36.1
18	16 16 25.55	11.13	2.81	21 34 24.3	155.9	0 15.1	2.054 601	10919	4.28	20 32.0
19	16 16 14.42	− 9.55	− 2.80	−21 37 00.2	− 157.8	+0 15.1	2.065 520	+11070	4.26	20 27.9
20	16 16 04.87	7.96	2.79	21 39 38.0	159.6	0 15.2	2.076 590	11218	4.24	20 23.8
21	16 15 56.91	6.37	2.79	21 42 17.6	161.4	0 15.2	2.087 808	11360	4.21	20 19.8
22	16 15 50.54	4.80	2.78	21 44 59.0	163.3	0 15.2	2.099 168	11499	4.19	20 15.8
23	16 15 45.74	3.23	2.77	21 47 42.3	165.1	0 15.2	2.110 667	11633	4.17	20 11.8
24	16 15 42.51	− 1.67	− 2.76	−21 50 27.4	− 166.9	+0 15.2	2.122 300	+11764	4.15	20 07.8
25	16 15 40.84	− 0.11	2.76	21 53 14.3	168.7	0 15.3	2.134 064	11891	4.12	20 03.8
26	16 15 40.73	+ 1.43	2.75	21 56 03.0	170.5	0 15.3	2.145 955	12013	4.10	19 59.9
27	16 15 42.16	2.97	2.74	21 58 53.5	172.2	0 15.3	2.157 968	12133	4.08	19 56.1
28	16 15 45.13	4.49	2.73	22 01 45.7	174.0	0 15.3	2.170 101	12249	4.06	19 52.2
29	16 15 49.62	+ 6.01	− 2.73	−22 04 39.7	− 175.6	+0 15.3	2.182 350	+12360	4.03	19 48.4
30	16 15 55.63	7.51	2.72	22 07 35.3	177.3	0 15.3	2.194 710	12470	4.01	19 44.6
31	16 16 03.14	9.00	2.71	22 10 32.6	179.0	0 15.3	2.207 180	12576	3.99	19 40.8
Aug. 1	16 16 12.14	10.49	2.70	22 13 31.6	180.6	0 15.3	2.219 756	12678	3.96	19 37.0
2	16 16 22.63	11 97	2.69	22 16 32.2	182.2	0 15.3	2.232 434	12777	3.94	19 33.3
3	16 16 34.60	+ 13.42	− 2.68	−22 19 34.4	− 183.7	+0 15.3	2.245 211	+12873	3.92	19 29.5
4	16 16 48.02		− 2.68	−22 22 38.1		+0 15.3	2.258 084		3.90	19 25.8

Approximate magnitude = 7.8

FOR 0^h UNIVERSAL TIME

Date	Apparent Right Ascension		Red. to Astrom. Place	Apparent Declination		Red. to Astrom. Place	True Distance from Earth		Hor. Parallax	Transit, Meridian of Greenwich
	h m s	s	s	° ′ ″	″	′ ″			″	h m
Aug. 4	16 16 48.02	+ 14.88	− 2.68	−22 22 38.1	− 185.3	+0 15.3	2.258 084	+12966	3.90	19 25.8
5	16 17 02.90	16.32	2.67	22 25 43.4	186.8	0 15.3	2.271 050	13056	3.87	19 22.2
6	16 17 19.22	17.76	2.66	22 28 50.2	188.3	0 15.3	2.284 106	13141	3.85	19 18.5
7	16 17 36.98	19.18	2.65	22 31 58.5	189.7	0 15.3	2.297 247	13224	3.83	19 14.9
8	16 17 56.16	20.59	2.64	22 35 08.2	191.0	0 15.3	2.310 471	13304	3.81	19 11.3
9	16 18 16.75	+ 21.99	− 2.63	−22 38 19.2	− 192.5	+0 15.3	2.323 775	+13379	3.79	19 07.8
10	16 18 38.74	23.37	2.62	22 41 31.7	193.7	0 15.3	2.337 154	13452	3.77	19 04.2
11	16 19 02.11	24.75	2.61	22 44 45.4	195.0	0 15.2	2.350 606	13521	3.74	19 00.7
12	16 19 26.86	26.12	2.60	22 48 00.4	196.2	0 15.2	2.364 127	13587	3.72	18 57.2
13	16 19 52.98	27.47	2.59	22 51 16.6	197.4	0 15.2	2.377 714	13649	3.70	18 53.7
14	16 20 20.45	+ 28.80	− 2.59	−22 54 34.0	− 198.5	+0 15.2	2.391 363	+13708	3.68	18 50.2
15	16 20 49.25	30.13	2.58	22 57 52.5	199.6	0 15.2	2.405 071	13763	3.66	18 46.8
16	16 21 19.38	31.44	2.57	23 01 12.1	200.5	0 15.2	2.418 834	13815	3.64	18 43.4
17	16 21 50.82	32.73	2.56	23 04 32.6	201.5	0 15.1	2.432 649	13864	3.62	18 40.0
18	16 22 23.55	34.01	2.55	23 07 54.1	202.3	0 15.1	2.446 513	13908	3.60	18 36.6
19	16 22 57.56	+ 35.27	− 2.54	−23 11 16.4	− 203.1	+0 15.1	2.460 421	+13950	3.58	18 33.3
20	16 23 32.83	36.51	2.53	23 14 39.5	203.9	0 15.1	2.474 371	13989	3.56	18 29.9
21	16 24 09.34	37.74	2.52	23 18 03.4	204.5	0 15.1	2.488 360	14024	3.54	18 26.6
22	16 24 47.08	38.96	2.51	23 21 27.9	205.2	0 15.1	2.502 384	14058	3.52	18 23.3
23	16 25 26.04	40.15	2.50	23 24 53.1	205.6	0 15.0	2.516 442	14087	3.50	18 20.1
24	16 26 06.19	+ 41.33	− 2.49	−23 28 18.7	− 206.2	+0 15.0	2.530 529	+14115	3.48	18 16.8
25	16 26 47.52	42.49	2.48	23 31 44.9	206.5	0 15.0	2.544 644	14140	3.46	18 13.6
26	16 27 30.01	43.63	2.47	23 35 11.4	206.9	0 15.0	2.558 784	14163	3.44	18 10.4
27	16 28 13.64	44.77	2.47	23 38 38.3	207.1	0 14.9	2.572 947	14184	3.42	18 07.2
28	16 28 58.41	45.89	2.46	23 42 05.4	207.3	0 14.9	2.587 131	14201	3.40	18 04.0
29	16 29 44.30	+ 46.98	− 2.45	−23 45 32.7	− 207.4	+0 14.9	2.601 332	+14217	3.38	18 00.8
30	16 30 31.28	48.08	2.44	23 49 00.1	207.6	0 14.8	2.615 549	14231	3.36	17 57.7
31	16 31 19.36	49.16	2.43	23 52 27.7	207.5	0 14.8	2.629 780	14243	3.35	17 54.6
Sept. 1	16 32 08.52	50.23	2.42	23 55 55.2	207.6	0 14.8	2.644 023	14251	3.33	17 51.5
2	16 32 58.75	51.28	2.41	23 59 22.8	207.4	0 14.7	2.658 274	14258	3.31	17 48.4
3	16 33 50.03	+ 52.31	− 2.40	−24 02 50.2	− 207.2	+0 14.7	2.672 532	+14263	3.29	17 45.3
4	16 34 42.34		− 2.39	−24 06 17.4		+0 14.7	2.686 795		3.28	17 42.3

Approximate magnitude = 8.3

NAVY-DPPO PRNC. WASH., D.C.